

Observation of the variation of the refraction height of Low Frequency Standard-time and Frequency Signal Emission

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Low Frequency (LF) radio waves are reflected in the lower ionosphere. The phases of the received LF radio wave vary with the length of ray path when the reflection height moves vertically. Therefore, the height variation of the ionosphere is observed by the variation of the phase of received LF radio wave. Since the LF observation is one of the useful method for the observation of the lower ionosphere, it is expected that it supplies important data for examining the lower ionosphere. This study examines the characteristics of the phase change of the LF Standard-time and Frequency Signal Emission. The observation target is the standard radio waves of 60 kHz, which are transmitted from Hagane-yama station. The radio waves are observed by crossed loop antenna at Numata, Gunma Prefecture and Sugadaira, Nagano Prefecture. In sunrise and sunset time, it is expected that the phase of the sky wave varies as the height of ionosphere varies. However, the variation is small because the signals of both sky and direct waves are mixed. Therefore, the sky wave was separated using the polar coordinate representation of the received radio wave. The variation of the ionospheric height was calculated from the phase of the sky wave, and this was compared with the distribution of the ionospheric conductivity. For example, daily variation, on Jan. 7, 2016, show that the height variation in ionosphere (14 km) is nearly twice as much as in pedersen conductivity of ionosphere (7 km). On the other hand, the variation pattern of reflection height is similar to seasonal and daily variation pattern of the conductivity. The difference of the height variation may be caused by the assumption that the absolute height of the ionosphere is assumed in calculating the height variation of the ionosphere.

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